The Invention Claimed Is

1. A method for transmitting data content provided in a data signal, comprising:

a) assigning distinct portions of the data signal to two or more respective channels;

b) for each channel, using corresponding assigned portions of the data signal to modulate an optical carrier at a respective wavelength associated with that channel; and

c) transmitting an optical output signal that comprises modulated carrier energy at each of the respective wavelengths, such that data content is carried, in the transmitted optical output signal, by energy at two or more of the respective wavelengths.

2. The method of claim 1, wherein the modulated carrier energy is transmitted in sequential segments, each such segment having a respective wavelength.

3. The method of claim 1, wherein the assigning step comprises assigning, to each channel, those portions of the data signal that coincide with a recurring time window allocated to that channel.

4. The method of claim 3, further comprising permuting the recurring time windows allocated to the channels, such that data content carried in the transmitted optical output signal occurs in a different sequence from the data content provided in the data signal.

5. The method of claim 4, wherein the permuting step is carried out using delay lines.

6. The method of claim 5 further comprising transmitting, as part of the optical output signal, information that describes how the time windows were permuted.

7. The method of claim 1, wherein the transmitting step comprises launching the optical output signal into an optical fiber.

8. The method of claim 1, wherein the transmitting step comprises launching the optical output signal into free space.

9. The method of claim 1, wherein:

a) the data signal is an electrical signal;

b) the assigning step comprises deriving two or more electrical driver signals from the data signal, each driver signal corresponding to a respective channel; and

c) the modulating step comprises using each driver signal to cause a respective optical emission device to emit an optical signal at a respective wavelength.

10. The method of claim 1, wherein the data signal is an optical signal having a wavelength λ_D, and the modulating step comprises:

a) providing optical radiation at two or more wavelengths to be referred to as coding wavelengths; and

b) mixing a respective portion of the data signal with optical radiation at each of the coding wavelengths in a nonlinear optical device, thereby to generate modulated radiation having a wavelength different from the wavelength λ_D and the coding wavelengths.

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~~11. The method of claim 6, wherein:~~

~~a) the assigning step comprises assigning, to each each channel, those portions of the data signal that coincide with a recurring time window allocated to that channel;~~

~~b) the optical radiation at each of the coding wavelengths is provided in the form of a train of pulses;~~

~~c) each train of pulses corresponds to a recurring time window allocated to one of the channels; and~~

~~d) the respective wavelength associated with each of the channels is a wavelength of modulated radiation generated by said non-linear mixing.~~

12. The method of claim 1, wherein:

a) the data signal is an electrical signal;

b) the method further comprises operating a tunable light source to produce output radiation that varies stepwise in wavelength according to a pattern; and

c) the assigning and modulating steps comprise using the data signal to modulate the output radiation such that each portion of the data signal is modulated onto an assigned wavelength of output radiation.

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13. The method of claim 8, wherein the output radiation is generated by ~~operating~~ a voltage-tunable laser.

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14. The method of claim 8, wherein the pattern of wavelength variation defines respective, recurring time windows during which data content is to be allocated to corresponding wavelength channels.

15. A method of optical communication, comprising:

receiving an optical signal that contains energy in two or more distinct wavelength channels;

assembling portions of the received optical signal, from distinct wavelength channels, into a single, sequential data stream; and

recovering data content from the assembled data stream.

16. The method of claim 15, wherein:

a) the method further comprises providing timing information that defines a succession of time windows for each of the channels; and

b) the assembling of signal portions is carried out in accordance with the timing information, such that in the assembled data stream, each portion of the received optical signal falls in assigned time windows according to the channel in which such portion was received.

17. The method of claim 16, wherein the received optical signal falls in time windows having a permuted sequence, and the method further comprises applying an inverse permutation to the time windows, such that data content carried in the received optical signal is restored to an original sequence.

18. The method of claim 17, wherein the inverse permutation is carried out using delay lines.

19. The method of claim 18, further comprising decoding, from the received optical signal, information that describes how the time windows were permuted.

Sub a4) 20. The method of claim 15, wherein:further comprising:

a) the method further comprises optically demultiplexing the received signal, thereby to provide two or more single-channel optical signals;

b) the method further comprises detecting each of the single-channel signals, thereby to provide two or more single-channel electronic signals; and

c) the assembling step comprises electronically multiplexing the single-channel electronic signals.

21. The method of claim 15, wherein:

a) the method further comprises optically demultiplexing the received signal, thereby to provide two or more single-channel optical signals;

b) the method further comprises shifting each of the single-channel signals into a common wavelength channel by non-linear optical mixing; and

c) the assembling step is carried out by optical multiplexing.

22. An optical communication system, comprising:

a source of a data signal having data content;

a system operative to apportion the data content into two or more distinct wavelength channels according to defined time windows such that each said channel receives a portion of the data content during its assigned time windows; and

an output element operative to couple an output optical signal into a transmission medium, wherein said output optical signal contains portions of the data content in two or more wavelength channels.

23. The optical communication system of claim 22, further comprising a scrambling element operative to permute the time windows, such that data content carried in the optical output signal occurs in a different sequence from the data content provided in the data signal.

24. The optical communication system of claim 23, wherein the scrambling element comprises delay lines.

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25. The optical communication system of claim 22, wherein:

the data signal source is an electronic signal source;

the apportioning system comprises an electronic demultiplexer operative in response to the data signal to generate two or more distinct driver signals;

the apportioning system further comprises a respective optically emissive device operative in response to each driver signal to generate a corresponding optical signal in a distinct wavelength channel; and

the output element comprises an optical demultiplexer operative to combine the respective optical signals and couple them into the transmission medium.

26. The optical communication system of claim 22, wherein:

the data signal source is an optical signal source; and

the apportioning system comprises a nonlinear optical device operative to shift selected portions of the data signal into respective wavelength channels.

27. The optical communication system of claim 22, wherein:

the data signal source is an electrical signal source;

the apportioning system comprises a voltage-tunable laser operative, in response to a voltage pattern, to emit radiation that, in respective time windows, occupies corresponding wavelength channels; and

the apportioning system further comprises a modulator, operative in response to the data signal to impose data content on the radiation emitted by the voltage-tunable laser.

28. An optical communication system, comprising:

a device operative to receive an input optical signal that contains data content in two or more distinct wavelength channels, and operative to separate portions of said input signal according to wavelength; and

a device operative to assemble said portions into a single, sequential data stream.

29. The optical communication system of claim 28, wherein: each wavelength channel is received in a respective recurring time window, the time windows are permuted such that data content is received in a sequence that differs from an original sequence, and the system further comprises an unscrambling element operative to permute the time windows, such that assembly of the portions into a single, sequential data stream will cause data content to occur in the original sequence.

30. The optical communication system of claim 28, wherein the unscrambling element comprises delay lines.

31. The optical communication system of claim 28, wherein:

the signal-receiving and separating device is an optical demultiplexer;

the optical communication system further comprises two or more optical receivers, each operative to convert optical signal portions in a respective wavelength channel to corresponding electrical signal portions; and

the assembling device comprises an electronic multiplexer in receiving relationship to said electrical signal portions.

32. The optical communication system of claim 28, wherein:

the signal-receiving and separating device is an optical demultiplexer;

the optical communication system further comprises two or more nonlinear optical devices, each operative to shift optical signal portions in a respective wavelength channel into a common wavelength channel; and

the assembling device comprises an optical multiplexer in receiving relationship to the optically shifted signal portions.